

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
APPLICATION FOR LETTERS PATENT

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TITLE: ELECTRONIC PROGRAM GUIDE SYSTEM USING IMAGES OF
REDUCED SIZE TO IDENTIFY RESPECTIVE PROGRAMS

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SECRET

BACKGROUND OF THE INVENTION

This invention relates to a technique for transmitting and receiving electronic program guide (EPG) data and, more particularly, to such a technique which permits a user to view, readily understand and select a desired one of several programs, such as television programs, that presently are being transmitted and that will be transmitted to the user's receiving apparatus.

Electronic program guides have been proposed wherein information, known as EPG data, representing different television programs that may be received by a user is transmitted over the same medium that is used to transmit the television programs themselves. For example, recently introduced satellite transmission systems, commercially available as Direct Satellite Broadcast Systems (DSS), provide a user with the ability to selectively receive one of a multiple of different broadcast channels, each of which has different television programming transmitted thereover. Typically, the user subscribes to a DSS provider and, depending upon the user's selection, different broadcast channels may be received from that provider. Some of these broadcast channels are used to transit what has become known as "premium" television programming; and depending upon subscription rates, subscription plans, and the like, a user may receive such premium television programming as well as special events, first-run movies, and the like. For example, with a single satellite dish receiver, a DSS subscriber presently may

1 receive on the order of about 80 broadcast channels, each
2 providing different television programming, movies, special
3 events. etc.

4 EPG data systems have been proposed, wherein EPG data
5 relating to each of the programs that may be transmitted on each
6 of the broadcast channels for a period of time (for example,
7 television program information for the next hour, several hours,
8 days, weeks, etc.) are transmitted. The EPG data may be
9 transmitted in-band (on the same broadcast channel as the
10 program) or out-of-band (on a separate broadcast channel not
11 normally used to carry programs). Such EPG data heretofore has
12 been in the form of text data only, thereby providing the user
13 with an EPG display of those television programs that are
14 transmitted on respective broadcast channels for a given period
15 of time. Once provided with this television program information,
16 the user then may tune his television receiving apparatus to a
17 desired broadcast channel at the proper time so as to receive the
18 selected program. Often, a user may not readily appreciate the
19 content of a particular television program simply from its
20 displayed title. Also, a user may need more information, other
21 than a simple title, to fully appreciate the type of television
22 programs that are available in order to make an informed
23 selection.

OBJECTS OF THE INVENTION

Therefore, it is an object of the present invention to provide an approved EPG technique which provides a user with adequate information relating to television programs (or other types of programs) that may be received.

Another object of this invention is to provide an improved EPG technique wherein the EPG data includes image data representing images of reduced, less than normal, size to identify respective programs which can be received.

A further object of this invention is to provide an improved EPG technique wherein the EPG data also includes text data representing information associated with each of the programs that presently are being transmitted and that will be transmitted and may be received by the user, the text data being selectively displayed as a table which provides a useful guide relating to several programs or as descriptive information relating to only a selected one of those programs.

An additional object of this invention is provide an improved EPG technique wherein EPG information is displayed as a plurality of reduced size images representing programs that presently are being transmitted and/or that will be transmitted, the reduced size images being superimposed onto a displayed program then being received.

Still another object of this invention is to provide a technique, as aforementioned, wherein receiving apparatus may be

1 tuned quickly to a desired broadcast channel carrying a program
2 which is identified by one of several concurrently displayed
3 reduced size images.

4 Various other objects, advantages and features of the
5 present invention will become readily apparent from the ensuing
6 detailed description, and the novel features will particularly
7 pointed out in the appended claims.

8 SUMMARY OF THE INVENTION

9 In accordance with this invention, an electronic
10 program guide (EPG) which identifies programs that are to be
11 transmitted is itself transmitted in the form of EPG data which
12 includes image data representing images of reduced, less than
13 normal size to identify respective programs. The EPG data is
14 combined with current program data then being broadcasted, and
15 the combined data is transmitted. At the receiver, the EPG data
16 is separated from the program data and the reduced size images of
17 the EPG data are displayed in superposition over a program on the
18 particular broadcast channel which a user may select.

19 As an aspect of this invention, the EPG data includes
20 text data representing information associated with each program
21 that is identified by the reduced size image data. For instance,
22 and as an illustrative numerical example, if program data
23 transmitted over 80 different broadcast channels may be received,
24 the EPG image and text data identify each program that is
25 transmitted over each of the 80 channels for a given period of

1 time (e.g., for the next hour, for the next several hours, for
2 the next day, for the several days, etc.). In addition to
3 displaying the images of reduced size, the user may select the
4 text data for display. Such text data may be displayed as a
5 table representing the programs that may be received over the
6 different broadcast channels for the given period of time, or the
7 text data may represent more detailed information concerning any
8 single program that may be selected by the user.

9 As a feature of this invention, the reduced size images
10 are single frame images that may be specially created to identify
11 each program or, alternatively, that may be selected from the
12 video frames normally constituting the respective programs.

13 BRIEF DESCRIPTION OF THE DRAWINGS

14 The following detailed description, given by way of
15 example and not intended to limit the present invention solely
16 thereto, will best be understood in conjunction with the
17 accompanying drawings in which:

18 Fig. 1 is a block diagram of a transmission system
19 which incorporates the present invention;

20 Fig. 2 is a block diagram of a portion of the apparatus
21 shown in Fig. 1;

22 Fig. 3 illustrates a promotion channel display derived
23 from the promotion channel transmitted by the apparatus shown in
24 Fig. 1;

1 Fig. 4 illustrates the EPG display produced by the
2 present invention;

3 Fig. 5 illustrates the title bar shown in Fig. 4;

4 Fig. 6 illustrates the reduced size images which are
5 displayed as EPG data in accordance with the present invention;

6 Fig. 7 illustrates EPG image and text display;

7 Fig. 8 illustrates a portion of the program table
8 display derived from the EPG data transmitted by the present
9 invention;

10 Fig. 9 illustrates a program table display for one
11 broadcast channel;

12 Fig. 10 illustrates a program content display derived
13 from the EPG data which is transmitted in accordance the present
14 invention;

15 Figs. 11A and 11B schematically illustrate the program
16 table data and the program content data which are transmitted by
17 normal broadcast channel transponders and by promotional channel
18 transponders, respectively;

19 Fig. 12 schematically illustrates the EPG data
20 transmitted by the normal broadcast channel transponders and the
21 promotional channel transponder;

22 Fig. 13 is illustrative of the EPG data;

23 Fig. 14 illustrates the data structure of the service
24 description table included in the EPG data;

1 Fig. 15 illustrates the data structure of the event
2 information table included in the EPG data;

3 Fig. 16 illustrates the data structure of still picture
4 data;

5 Fig. 17 illustrates the data structure of the time and
6 data table included in the EPG data;

7 Fig. 18 illustrates the data structure of the program
8 map table included in the EPG data;

9 Fig. 19 illustrates the data structure of the program
10 association table included in the EPG data;

11 Fig. 20 illustrates a video receiving system which
12 incorporates the present invention;

13 Fig. 21 is a block diagram of the electrical
14 connections shown in Fig. 20;

15 Fig. 22 illustrates the receiver/decoder 2 of Fig. 20;

16 Fig. 23 is a block diagram of one embodiment of a
17 receiver/decoder in accordance with the present invention;

18 Fig. 24 illustrates a remote control device which
19 utilizes the present invention;

20 Fig. 25 illustrates an alternative embodiment of a
21 portion of the remote control device shown in Fig. 24;

22 Fig. 26 is a schematic representation of a portion of
23 the remote control device shown in Fig. 24;

1 Fig. 27 schematically represents the manner in which
2 EPG data is transmitted and received in accordance with the
3 present invention; and

4 Fig. 28 is a block diagram of the manner in which EPG
5 data is stored and retrieved at the receiver shown in Fig. 23.

6 DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

7 Referring now to the drawings, wherein like reference
8 numerals are used throughout to identify similar elements, and in
9 particular to Fig. 1, there is illustrated a block diagram of one
10 embodiment of a transmission system which incorporates the
11 present invention. In this embodiment, electronic program guide
12 (EPG) data and program data are transmitted from, for example, a
13 suitable ground station to a satellite from which the EPG and
14 program data are distributed to compatible receiving devices.
15 Although the embodiments illustrated herein are described in
16 conjunction with satellite transmission systems, such as direct
17 video broadcast (DVB), DSS and other satellite systems, it will
18 be readily appreciated that the teachings of this invention are
19 equally applicable to the transmission of program and EPG data
20 via conventional over-the-air broadcast systems (such as VHF and
21 UHF systems), cable television systems, and the like. For
22 convenience, however, Fig. 1 is illustrated and described in
23 conjunction with satellite transmission systems wherein a
24 satellite is provided with a plurality of transponders, each of
25 which is operable to transmit several broadcast channels of

1 program data. For example, each transponder may be operable to
2 transmit ten broadcast channels (e.g., PBS, NBC, HBO, etc.), but
3 for convenience and simplification, each transponder is described
4 herein as transmitting five broadcast channels. Also, and as
5 will be explained, a separate transponder, described as a
6 promotion channel transponder, is dedicated to the transmission
7 of two or more promotion channels. Again, for convenience, while
8 the promotion channel transponder is described as being operable
9 to transmit only two promotion channels, it will be readily
10 appreciated that a greater number of promotion channels may be
11 transmitted thereby.

12 Digital video and audio program data (V/A) provided for
13 transmission by each of several broadcast channels are supplied
14 to a switcher 301. The video and audio program data are referred
15 to as program data; and it will be appreciated that such program
16 data constitutes a television program provided by conventional
17 television stations, such as PBS, NBC, TBS, and the like. The
18 television stations with which the present invention finds ready
19 application are not limited solely to those television stations
20 which operate in the United States; and Fig. 1 illustrates
21 several different television stations which are located in the
22 United States, Japan and elsewhere. It will also be appreciated
23 that the program data provided by one of these broadcast channels
24 need not be limited to television programming; and,
25 alternatively, such program data may be suitable program

1 information produced by other types of data bases. Accordingly,
2 it will be understood that, as used herein, "program data" refers
3 to television programming as well as such other types of program
4 information produced by other data bases.

5 Switcher 301 is coupled to a program control device 308
6 which controls the switcher to divide the program data supplied
7 thereto via respective broadcast channels into groups of
8 broadcast channels. Each such broadcast channel carries the
9 aforementioned program data which currently is being transmitted.
10 Assuming that the program data transmitted on a respective
11 broadcast channel contains video and audio data, each group of
12 five broadcast channels is coupled to a respective MPEG encoder
13 301-1, 303-2, . . . 303-7 wherein the video and audio data are
14 compressed in accordance with the known MPEG standard. Program
15 control device 308 also controls switcher 301 to couple two
16 broadcast channels to a promotion channel generator 302 which is
17 described in greater detail in connection with Fig. 2. Suffice
18 it to say that the promotion channel generator operates to
19 produce promotion program data which, as will be described,
20 differs from the broadcast channel program data primarily in that
21 the promotion channel program data consists of single frame video
22 data used to promote particular broadcast channels which carry
23 television program data that may be of special interest. The
24 promotion channel program data may be thought of as special
25 advertising data that may be prepared by special sponsors; and

1 the transmission of such promotion program data over the selected
2 promotion channels is a service purchased by such sponsors.

3 EPG data is generated by an EPG data generator 309 and
4 is formed of image data representing viewable images of reduced
5 size (EPG 1) and text data (EPG 2 and EPG 3, to be described).
6 In one embodiment, the EPG image data is separately generated and
7 stored (not shown) as a single frame of video data representing
8 an image that is typical of a respective program. For example,
9 if the transmission system shown in Fig. 1 is operable to
10 transmit 80 broadcast channels of program data and if each
11 broadcast channel operates, on the average, to broadcast 30
12 different programs in a 24 hour period, $30 \times 80 = 2400$ frames of
13 reduced size images are stored as the EPG image data (EPG 1) for
14 each 24 hour period. In the preferred embodiment, however,
15 switcher 301 supplies to EPG data generator 309 a selected frame
16 contained in each program supplied to the switcher over the
17 respective broadcast channels. The EPG generator includes a
18 Joint Photographic Experts Group (JPEG) encoder 310 which is
19 supplied with the respective video frames selected by switcher
20 301 to encode those frames in accordance with the JPEG standard
21 thereby producing the EPG image data (EPG 1).

22 As will described below, the promotion program data
23 that is received and displayed on television receiving apparatus
24 includes icons which represent different categories of programs
25 (e.g., movie, drama, comedy, sport, etc.), logos adopted by the

1 different broadcast channels and other graphic displays. The
2 transmission of such icons, logos and graphic displays may occupy
3 a large amount of the data capacity of the promotion program
4 data. It is preferable, then, to pre-store at each receiver (as
5 by conventional sending and storing techniques) the
6 aforementioned, icons, logos and graphic displays and then
7 transmit, as part of the promotion program data, access
8 information which is used at the receiver to read out and display
9 the pre-stored icons, logos and graphic displays. Such access
10 data may be, for example, bit-map data; and as illustrated in
11 Fig. 1, such access data is generated by EPG data generator 309
12 and supplied to promotion channel generator 302 whereat it is
13 combined with the program data of the two broadcast channels
14 selected as promotion channels by switcher 301.

15 Each MPEG encoder 303-1 ... 303-7 compresses the video
16 and audio data included in the program data supplied thereto by
17 the respective group of five broadcast channels. The compressed
18 program data produced by MPEG encoder 303-1 is coupled to a
19 multiplexer 304-2; the compressed program data produced by MPEG
20 encoder 303-2 is coupled to a multiplexer 304-3, and so on,
21 whereby the compressed program data produced by MPEG encoder 303-
22 7 is coupled to a multiplexer 304-8. It is seen, then, that each
23 multiplexer 304-2 ... 304-8 is supplied with five broadcast
24 channels of compressed program data. An additional multiplexer
25 304-1 is coupled to promotion channel generator 302 to receive

1 the promotion program data derived from the two broadcast
2 channels selected by switcher 301 as well as the bit-map data
3 generated by EPG data generator 309, as will be described in
4 greater detail in connection with Fig. 2.

5 EPG image data (EPG 1) is supplied from EPG data
6 generator 309 to each of multiplexers 304-1 ... 304-8 and EPG
7 text data (EPG 2) also is supplied from the EPG data generator to
8 each of these multiplexers. The EPG image data (EPG 1) is
9 comprised a single frame of video data, processed to be of
10 reduced size, and is referred to herein as still picture data;
11 and the EPG text data (EPG 2) is referred to herein as program
12 guide text data. The program guide text data (EPG 2) is
13 associated with, for example, 80 broadcast channels and includes
14 information, such as channel identification, program title,
15 broadcast time and date and other descriptive material, relating
16 to the program which is to be transmitted. This program guide
17 text data (EPG 2) is associated with programs to be transmitted
18 over a predetermined time duration, such as programs that
19 currently are being transmitted as well as programs that will be
20 transmitted over the next 24 hours. EPG data generator 309 is
21 operable to generate additional program guide text data (EPG 3)
22 which is similar to EPG 2 but relates to programs that will be
23 transmitted for an additional period of time, for example,
24 programs that will be transmitted for an additional 126 hours.
25 Figs. 11A and 11B, which will be described below, schematically

1 illustrate the relationship between the program guide text data
2 EPG 2 and EPG 3. In the preferred embodiment described herein,
3 program guide text data (EPG 3) is supplied to multiplexer 304-1
4 for transmission with the promotion program data. As mentioned
5 above, the promotion program data may be thought of as being
6 transmitted over the promotion channel and serves the function of
7 promoting particular programs transmitted on one or more of the
8 broadcast channels.

9 Each of multiplexers 304-1 ... 304-8 operates to
10 multiplex the EPG and program data to supplied thereto to produce
11 a data output channel. The respective data output channel,
12 comprised of multiplexed EPG1, EPG2 and compressed program data
13 (the data output channel from multiplexer 304-1 also includes EPG
14 3) is coupled to a digital modulator 305-1 ... 305-8 which
15 performs digital modulation on the multiplexed EPG and program
16 data produced by each of the respective multiplexers. For
17 example, each digital modulator may perform quadrature phase shift
18 keying (QPSK), EFM, or other conventional digital modulation.
19 The resulting digital modulated data output channels produced by
20 the digital modulators are transmitted to respective transponders
21 located on a satellite by means of a synthesizer 306 and a
22 ground-to-satellite antenna 307. In the embodiment shown in Fig.
23 1, the digital modulators and synthesizer transmit the data
24 output channels from multiplexers 304-1 304-8 respectively,
25 to a corresponding one of 8 transponders. The transponders to

1 which the modulated data output channels from multiplexers 304-2
2 ... 304-8 are supplied are referred to as normal broadcast
3 transponders 2, 3, 8 and the transponder to which the
4 modulated data output channel from multiplexer 304-1 is supplied
5 is referred to as the promotion channel transponder, also known
6 as the "guide" transponder. These transponders are used to
7 transmit the promotion channels and the broadcast channels to
8 receiving devices that are furnished with compatible satellite
9 dish antennas.

10 It is seen, then, that if the EPG data represents
11 programs broadcasted on 80 broadcast channels, each of the data
12 output channels from multiplexers 304-1, . . . 304-8 contains the
13 same EPG data. As mentioned above, in the embodiment described
14 herein, the data output channel from multiplexer 304-1 contains
15 additional EPG data namely EPG 3.

16 Promotion channel generator 302 is illustrated in
17 greater detail in Fig. 2. Two single frame generators 332-1 and
18 332-2 are coupled to switcher 301 to receive therefrom the video
19 and audio data transmitted over the two broadcast channels
20 selected as the promotion channels by the switcher. As an
21 example, the promotion channels need not necessarily be network
22 television channels normally used to broadcast network television
23 programming. Rather, the promotion channels may be separate,
24 dedicated channels made available to sponsors such as other
25 commercial television networks for the purpose of broadcasting to

1 consumers information relating to sponsored programs. Each of
2 the single frame generators processes the video data supplied on
3 the broadcast channel selected as the promotion channel to
4 generate single video frames. For example, the same video frame
5 may be transmitted for a given time interval, such as for a
6 second, for a minute or for several minutes.

7 The output from single frame generator 332-1 is
8 referred to as single-frame data and is supplied to a
9 superimposer 333-1. The audio data associated with the broadcast
10 channel that has been selected by switcher 301 as the promotion
11 channel is coupled from single frame generator 332-1 to an
12 encoder 334-1 which, as illustrated in Fig. 2, is identified as
13 an MPEG video/audio encoder. In a similar manner, the single-
14 frame data produced by single frame generator 332-2 is supplied
15 to a superimposer 333-2; and the audio data contained in the
16 broadcast channel which has been selected by switcher 301 as the
17 promotion channel is coupled from single frame generator 332-2 to
18 an MPEG video/audio encoder 334-2. Superimposers 333-1 and 333-2
19 also are supplied with the aforementioned access data generated
20 by EPG data generator 309 and referred to heretofore as bit-map
21 data. This access data is combined with the single-frame data by
22 the superimposer; and the combined data is coupled to a
23 respective one of the MPEG video/audio encoders.

24 Each MPEG video/audio encoder operates to compress the
25 single-frame video data, the superimposed access data and the

1 audio data supplied thereto. The resultant compressed promotion
2 channel program data from encoders 334-1 and 334-2 are
3 multiplexed together by a multiplexer 335 and supplied as
4 promotion channel program data to multiplexer 304-1 of Fig. 1.

5 A display of the promotion program data processed by
6 single frame generator 332-1, superimposer 333-1 and MPEG
7 video/audio encoder 334-1 is illustrated in Fig. 3. It will be
8 seen that text data produced by EPG data generator 309, as well
9 as a logo display, are superimposed onto the single frame of
10 video data produced by single frame generator 332-1. Here, the
11 text data reads: "promotion channel", "NHK channel 1", "program
12 presentation". Thus, the text data provides the promotional
13 information which, in this instance is sponsored by the NHK
14 television broadcast network of Japan. It will be understood
15 that the single frame video display is itself an advertisement
16 which may be paid for by a sponsor.

17 The NHK logo shown in Fig. 3 may, in one embodiment be
18 generated by EPG data generator 309 (Fig. 1) or may be stored at
19 the receiving device (to be described) and accessed from storage
20 by the transmission of suitable access data (such as bit-map
21 data) generated by the EPG data generator and transmitted over
22 the promotion broadcast channel.

23 To best appreciate the electronic program guide which
24 is transmitted, received and displayed in accordance with the
25 present invention, reference is made to Figs. 4-10 which

1 illustrate the respective displays that are selectively produced
2 from the EPG data transmitted by the apparatus shown in Fig. 1.
3 As will be described, it is preferred that the transmitted EPG
4 data not be displayed automatically. Rather, such EPG data is
5 stored at the receiver (Fig. 23) and selectively retrieved from
6 storage by the user's operation of a suitable remote control
7 device of the type shown in Fig. 24. Hence, when the EPG display
8 is not selected, the receiving apparatus, and more particularly
9 the television monitor displays whatever program currently is
10 being transmitted over the broadcast channel and that has been
11 selected by the user. When the user wishes to exploit the EPG
12 data that has been transmitted to and stored at his receiver, he
13 selects an EPG display mode (as will be described), resulting in
14 the display of several images of reduced, less than normal size,
15 superimposed over the program which then is being received over
16 the broadcast channel to which the receiver is tuned. Fig. 4
17 illustrates the superposition of, for example, five reduced size
18 images, also referred to as still picture images or EPG images,
19 displayed in what is referred to as a program window,
20 superimposed over the "normal size" display of the program which
21 then is being received. Each still picture image is reproduced
22 from image data EPG 1 produced by EPG data generator 309, as
23 aforescribed. For ease of understanding a category icon is
24 superimposed on each respective still picture image, thereby
25 enabling the user to identify quickly the type of program that is

1 identified by that still picture image. These category icons may
2 be generated by EPG data generator 309 and included as the still
3 picture data EPG 1 or, alternatively, the category icons may be
4 stored at the user's receiver and accessed therefrom by suitable
5 access data, such as bit-map data, included with the still
6 picture data EPG 1 generated by the EPG data generator.

7 As mentioned above, in the preferred embodiment of the
8 present invention, the EPG image data EPG 1 represents all of the
9 programs which currently are being transmitted on the broadcast
10 channels (for example, all of the programs currently being
11 transmitted on the 80 broadcast channels) and may also represent
12 those programs which will be transmitted over a given period of
13 time (for example, over the next 1, 4 or 24 hours) on the
14 broadcast channels. Such EPG image data is stored at the
15 receiver and selectively retrieved and displayed by the user in
16 response to his operation of the remote control device. Thus,
17 the user may display and scroll through various still pictures,
18 thereby discerning those programs which he may wish to view. A
19 cursor is displayed adjacent or, alternatively, superimposed over
20 the still pictures, this cursor being positionable at or over a
21 desired still picture, as selected by the user, for the purpose
22 of displaying EPG text data associated with the program
23 identified by that still picture or, in accordance with one
24 embodiment, to tune the user's receiver to the broadcast channel

1 over which the program identified by that still picture is
2 transmitted.

3 In addition to the program window superimposed over the
4 program display, as shown in Fig. 4, the EPG display mode
5 preferably displays information in a "title bar" that also is
6 superimposed on the program display. In one embodiment, the
7 title bar displays text data that is associated with the
8 displayed program, such as the broadcast channel over which the
9 program is transmitted, the title of that program and,
10 optionally, an icon representing the category of that program.
11 As the user tunes his receiver to a different broadcast channel,
12 the information displayed in the title bar changes in a similar
13 manner to display the broadcast channel, title of the program and
14 category of that program to which the receiver now is tuned. It
15 will be appreciated that the information displayed in the title
16 bar is included in the program data supplied to and encoded by
17 the MPEG encoders 303-1 . . . 303-7 of Fig. 1.

18 Alternatively, the information displayed in the title
19 bar shown in Fig. 4 may be associated with the program identified
20 by the still picture that has been selected by the cursor. That
21 is, depending upon the particular still picture to which the user
22 places the cursor, the title bar displays the title of the
23 program identified by that still picture, the broadcast channel
24 over which that program is transmitted and the category of that
25 program.

1 Fig. 5 illustrates the title bar shown in Fig. 4 and
2 Fig. 6 illustrates the program window which contains the EPG
3 images also shown in Fig. 4.

4 The EPG text data associated with the program
5 identified by a selected still picture may be selectively
6 displayed by appropriate user-operation of the remote control
7 device. As mentioned above, the EPG image data as well as the
8 EPG text data are stored at the receiver. It is expected the
9 user will position the cursor on or adjacent a desired still
10 picture and then operate a suitable selector button on his remote
11 control device to retrieve and display the EPG text data as shown
12 in Fig. 7. Preferably, this display constitutes a full screen
13 display, although the information shown in Fig. 7 may be
14 displayed in a suitable "window" on the display screen. It is
15 seen that the display includes the still picture image
16 represented by EPG image data EPG 1 as well as text data
17 represented by EPG text data EPG 2. In the example shown in Fig.
18 7, this EPG text data includes the date and time of broadcast of
19 the program identified by the still picture, the broadcast
20 channel over which this program is transmitted, the cast and also
21 a synopsis of that program. The cast and synopsis may be thought
22 of as detailed program information referred to as program content
23 data. The title, date and time of the program to be transmitted
24 are referred to as brief program information and are included in

1 program table data to be described. Fig. 7 also illustrates the
2 title bar discussed above in conjunction with Figs. 4 and 5.

3 The EPG text data EPG 2 and EPG 3 normally are stored
4 at the user's receiver and, depending upon the display mode
5 selected by the user, such EPG text data may be displayed in the
6 form of a table to display the programs that will be transmitted
7 over the broadcast channels for a given time period, such as
8 shown in Fig. 8, or may be displayed as a program table
9 representing the programs that will be transmitted over a
10 particular broadcast channel, such as shown in Fig. 9, or as a
11 detailed program display associated with a particular program
12 selected by the user, such as shown in Fig. 10. In each of these
13 figures, the EPG text data is superimposed over the
14 aforescribed promotion channel display. Nevertheless, it will
15 be appreciated that the EPG text data shown in Figs. 8, 9 and 10
16 may be superimposed over a program then being received by one of
17 the other broadcast channels, or the display may be a full screen
18 display with no background images.

19 The program table shown in Fig. 8 displays the titles
20 of those programs which are transmitted by respective broadcast
21 channels for particular periods of time. It is expected that the
22 displayed table will list less than all of the eighty broadcast
23 channels (which has been used as the illustrative example), and
24 the user may scroll through additional, similar display screens
25 to display the television programs to be transmitted over the

1 additional broadcast channels. Likewise, the program table
2 display of Fig. 8 depicts those programs which are transmitted
3 over a three hour duration; and since the EPG text data includes
4 EPG data associated with many more hours of programming, the user
5 may scroll through additional display screens to display those
6 programs which will be transmitted at later times.

7 The program table display of Fig. 9 is similar to that
8 of Fig. 8, except that the Fig. 9 display is limited to those
9 programs which are transmitted over a particular single broadcast
10 channel. The table of Fig. 9 may illustrate those programs which
11 are to be transmitted over, for example, a five hour duration;
12 and the user may scroll through additional display screens in
13 order to display the additional programs to be transmitted at
14 later times over this broadcast channel. Whereas Figs. 8 and 9
15 depict program tables which display what may be thought of as
16 brief program information (e.g. time of transmission, program
17 title and broadcast channel), Fig. 10 illustrates a display of
18 more detailed information, referred to herein as program content
19 data. This information is included in the EPG text data EPG 2
20 (and EPG 3) produced by EPG data generator 309 of Fig. 1; and
21 preferably is updated periodically, such as every 15 minutes.
22 This detailed program information includes, for example, a
23 description or synopsis of a particular program, its cast, its
24 date of production, and other information that may be of use to
25 the user. Such information may be retrieved from the EPG text

1 data stored at the receiver by suitable operation of the remote
2 control device. For example, the cursor may be used to select a
3 particular still picture that is displayed, and then an
4 information button on the remote control device may be operated
5 to read out the display shown in Fig. 10 which is associated with
6 the program identified by that still picture. Alternatively, a
7 cursor may be used to select a particular program that is
8 displayed in the program table of Fig. 8 or the program table of
9 Fig. 9, thereby retrieving the text data shown in Fig. 10 which
10 is associated with the selected program.

11 It will be recognized that the EPG text data needed to
12 display the program table shown in Fig. 8 or Fig. 9, the detailed
13 program information shown in Fig. 10 and the information screen
14 shown in Fig. 7 occupies much of the available transmission
15 capacity of the data output channels produced by multiplexers
16 304-1 . . . 304-8 of Fig. 1. If each data output channel
17 includes all of the EPG data needed to transmit the still EPG
18 images and all of the EPG text data, the remaining data capacity
19 of these data output channels may not be sufficient for adequate
20 transmission of the video and audio data. To obviate this
21 disadvantage, it is preferred to transmit a lesser amount of EPG
22 data with the "normal" broadcast channels than with the promotion
23 broadcast channels. That is, and with reference to Fig. 1, it is
24 preferred to transmit a lesser amount of EPG data on the data
25 output channels of multiplexers 304-2 . . . 304-8 than on the

1 data output channel from the multiplexer 304-1. This is attained
2 by supplying EPG data EPG 1 and EPG 2 to multiplexers 304-2 . . .
3 304-8 and to supply EPG data EPG 1, EPG 2 and EPG 3 to
4 multiplexers 304-1. The difference between the EPG data
5 represented by EPG 2 and EPG 3 is schematically represented in
6 Figs. 11A and 11B.

7 Fig. 11A schematically illustrates the EPG data that is
8 supplied to and transmitted by the "normal" transponders, namely
9 those transponders which are used to transmit the normal
10 broadcast channels received on the data output channels from
11 multiplexers 304-2 ... 304-8. Fig. 11B schematically represents
12 the EPG data that is supplied to and transmitted by the
13 transponder assigned to transmit the promotion broadcast
14 channels, this transponder being referred to hereinabove as the
15 "guide" transponder, and received on the data output channel from
16 multiplexer 304-1. The EPG text data EPG 2 supplied to a normal
17 transponder includes program table data (referred to as "brief
18 program information") and program content data (referred to as
19 "detailed program information"). It is assumed that the program
20 table and program content data are associated with programs that
21 are transmitted over, for example, 80 broadcast channels. Since
22 the amount of data needed to represent the program table for a
23 given channel is less than the amount of data needed to represent
24 the program content for that channel, the program table data may
25 represent program information for the 80 channels which are

1 transmitted over a greater period of time and the program content
2 data may represent program information for the 80 channels which
3 are transmitted over and shorter period of time. For example,
4 the program table data EPG 2 of the type shown in Fig. 8 may
5 represent the programs transmitted over the 80 broadcast channels
6 for a twenty-four (24) hour period, whereas the program content
7 data EPG 2, shown in Fig. 10, may represent the programs
8 transmitted over these 80 channels for a shorter period of time,
9 such as four (4) hours. In one embodiment, the EPG image data
10 EPG 1 represents the programs that will be transmitted over these
11 80 channels for the next one hour period; and in another
12 embodiment, the EPG image data represents the programs that will
13 be transmitted over, for example, a 24 hour period.

14 A greater amount of EPG data is transmitted by the
15 guide transponder, as depicted in Fig. 11B. Although the guide
16 transponder may transmit normal programming in addition to
17 promotion programs, the amount of normal programming transmitted
18 by the guide transponder is less than that transmitted by the
19 normal transponder, thus increasing the available data capacity
20 for transmission of the EPG data. Thus, the guide transponder
21 may transmit program table data EPG 2 for 80 broadcast channels
22 over a 24 hour period, and the guide transponder also may
23 transmit program table data EPG 3 representing the programs
24 transmitted by those 80 broadcast channels over the succeeding
25 126 hours. The guide transponder thus may transmit still picture

1 data EPG 1, program table data EPG 2 and program table data EPG 3
2 representing the programs transmitted over 80 broadcast channels
3 for a 150 hour period. It is appreciated that this large
4 quantity of EPG data may be used by the consumer to properly plan
5 and select programs for viewing over a relatively long term (for
6 example, over a 5-day period).

7 Fig. 11B also illustrates the program content data (for
8 example, the data which is displayed in Fig. 10) that may be
9 transmitted by the guide transponder for 80 broadcast channels.
10 In the example illustrated, the guide transponder transmits
11 program content data EPG 2 associated with the programs
12 transmitted by 80 broadcast channels over the next 4 hours; and
13 the guide transponder also transmits the program content data EPG
14 3 associated with the programs transmitted over these broadcast
15 channels for the next-following 66 hours. It will be seen, then,
16 that by receiving the EPG data from the normal and guide
17 transponders, a sufficient quantity of EPG data may be stored at
18 the receiver to permit the user to display EPG still pictures,
19 brief program information as well as detailed program information
20 relating to those programs currently being transmitted and those
21 programs which will be transmitted over the next few days. It
22 also will be recognized that the program content data is
23 associated with those programs that will be transmitted during a
24 fraction of the time interval that is represented by the program
25 table data. Whereas the program table data transmitted by the

1 normal transponder is associated with programs that will be
2 transmitted over a 24 hour period, the program content data
3 transmitted by the normal transponder is associated with programs
4 that will be transmitted over only a 4 hour period. Likewise,
5 whereas the program table data that is transmitted by the guide
6 transponder relates to programs that will be transmitted over a
7 150 hour period, the program content data that is transmitted by
8 the guide transponder is associated with programs that will be
9 transmitted over a 70 hour period.

10 Fig. 12 schematically represents the EPG data that is
11 transmitted by the guide transponder, identified as transponder
12 1, and the normal transponders, identified as transponder 2 . . .
13 transponder 8. The guide transponder is supplied with and
14 transmits program table data associated with programs transmitted
15 over a 150 hour period and with program content data associated
16 with those same programs, but transmitted over a 70 hour period.
17 The guide transponder also is supplied with the EPG still image
18 data and also with the program data of the promotion broadcast
19 channels, namely the single frame data discussed above in
20 conjunction with Figs. 1 and 2. Each of the normal transponders
21 is supplied with program table data associated with programs that
22 will be transmitted over a 24 hour period and with program
23 content data associated with those same programs but transmitted
24 over a 4 hour period. Each normal transponder also is supplied
25 with the EPG image data and with the program data transmitted

1 over several broadcast channels. In the example discussed in
2 conjunction with Fig. 1, it has been assumed that each of the
3 normal transponders operates to transmit 5 broadcast channels;
4 but in a practical embodiment, it is expected that each normal
5 transponder is operable to transmit up to 10 or more broadcast
6 channels. Likewise, in a practical implementation, the guide
7 transponder need not be limited solely to the transmission of
8 promotion programs (together with, of course, EPG data), but may
9 be used to transmit regular broadcast channels as well, such as 2
10 promotion channels and 8 broadcast channels. It will be
11 recognized that the present invention should not be limited
12 solely to the examples described above; and this invention is
13 readily applicable with any practical number of broadcast and
14 promotion channels.

15 Although forming no part of the present invention per
16 se, one construction of the EPG data that may be produced by EPG
17 data generator 309 now will be described.

18 The EPG data, as well as other types of accessory data,
19 is transmitted in a Direct Video Broadcast (DVB) System as
20 service information (SI). The data used to produce and display
21 an electronic program table is shown in Fig. 13. A Service
22 Description Table (SDT) includes service provider data which
23 identifies the provider of the transmission service (e.g. the
24 broadcast channel), the service name and the service type. For
25 example, the service type may indicate whether the type of

1 service is single frame service (promotion_service). The title
2 of a program to be transmitted is defined as the event_name in
3 the Short Event Descriptor of an Event Information Table (EIT)
4 and may include up to 60 bytes. The subtitle (type) is
5 represented as the Component Descriptor of the EIT. The current
6 date and time is defined as UTC_time in the Time and Date Table
7 (TDT), whereas the program start time is represented as
8 start_time of the EIT and the program duration is established by
9 the end_time of the EIT. A rating code representative of, for
10 example, violence, profanity and nudity of the program, is
11 included in the Parental Rating Descriptor of the EIT. The video
12 mode is represented as a Component Descriptor of the EIT. The
13 provide language (e.g. the language in which the program is
14 provided) is represented in the ISO639 Language Descriptor of a
15 Program Map Table (PMT). The sound mode is represented in the
16 Component Descriptor of the EIT. The category of the program is
17 set out in the Content Descriptor of the EIT.

18 The brief explanation of the program, such as the cast
19 (see Fig. 7), the overall program data (see the program table of
20 Fig. 8) and the channel program table (see Fig. 9) are
21 represented as the 64-byte data referred to as the Short Event
22 Descriptor of the EIT. The detailed program explanation, such as
23 the synopsis (or content explanation) shown in Fig. 7 and the
24 detailed program explanation shown in Fig. 10 are represented as
25 the 256-byte data referred to as the Extended Event Descriptor of

1 the EIT. Promotion information, such as the information shown in
2 Fig. 3, including the item name ("Promotion Channel 1, NHK"), the
3 item content ("Program Introduction"), and the station logo, are
4 represented as the Promotion Descriptor of the SDT.

5 Fig. 14 illustrates the data structure of the SDT
6 (Service Descriptor Table). The SDT includes data representing
7 the services included in the system, such as the service name,
8 the service provider, etc. The number in parentheses in Fig. 14
9 represents the number of bytes used to represent the information
10 identified thereby. The leading 10 bytes are used as a header
11 that is formed of common structure 1(3), transport stream
12 identification (transport stream_id (2)), common structure 2(3),
13 and original network identification (original_network_id(2)).
14 The transport stream ID may be thought of as a label for
15 distinguishing the transport stream from the SDT from other
16 transport streams multiplexed in the same delivery system. The
17 original network ID may be thought of as a label for identifying
18 the network which serves as the source of the delivery system.

19 Following the header are service descriptors loop [0]
20 to service descriptors loop [N] and, finally, error-correcting
21 code CRC_32(4). Each service descriptors loop includes
22 service_id(2), six reserved bits, EIT_schedule_flag,
23 EIT_present/following_flag, running_status, and free_CA_mode.
24 The service_id serves as a label for distinguishing the service
25 in this descriptor from the other services in the same transport

1 stream. The service_id performs the same function as the program
2 number (program_number) in the corresponding program map table
3 (PMT) (program_map_section) of Fig. 18. The EIT_schedule_flag
4 indicates the presence or the absence of the EIT_schedule
5 information in the EIT transport stream. The
6 EIT_present/following_flag represents the presence or the absence
7 of the EIT_present/following information in the EIT transport
8 stream. The running status designates the status of the service
9 (or program), such as whether the service (or broadcast channel)
10 has or has not yet started, is beginning to start in a few
11 minutes (this is useful for setting up a VCR for recording), has
12 already started, or is currently suspended. The free_CA_mode
13 indicates whether the service or broadcast channel can be
14 accessed free of charge or is controlled by a conditional access
15 system (such as pay per view, premium subscriber, etc.).

16 Following the free_CA_mode bit is the
17 descriptor_loop_length to identify the overall byte length of
18 subsequent descriptors. The adjacent service_descriptor[i]
19 supplies the name of the service_provider and the name of the
20 service in text format, as well as the service_type. The next
21 following country_availability_descriptor[i] represents a list of
22 the counties that can access the service and a list of the
23 countries that cannot. The subsequent descriptors include the
24 promotion description.

Fig. 15 illustrates the data structure of the Event Information Table (EIT). The leading 10 bytes are used for the header that is formed of the common structure 1(3), service_id(2), the common structure 2(3), and the transport stream identification transport_stream_id(2). Following the header is the original_network_id(2) and a last_table_id(1). The last_table_id(1) identifies the final (or maximum) table_id. If only a single table is used, the table_id is set. If table_id assumes consecutive values, this information is stored in chronological order. There follow event descriptors loop[0] to event descriptors loop[N] and finally, CRC_32(4).

Each event descriptors loop includes event_id(2) to provide the identification number of the event (or program) that is described, and start_time (5) for displaying the start time of the event in Universal Time Coordinates (UTC) and Modified Julian Day Coordinates (MJD). In this start time field, 16 least significant bits (LSB) of the MJD-displayed data are provided, and six digits represented by four-bit binary-coded decimal (BCD) symbols, or 24 bits. For example, 93/10/12 12:45:00 can be coded as OXC078124500. Following the start time data is the duration (3) which represents the duration of the event (program) in hours, minutes and seconds. Thereafter are the running_status, free_CA_mode, and descriptor_loop_length (1.5). Then, Short_event_descriptor[i](7+α) is provided to identify the event name and provide a short description of the event such as in the

1 form of the program table. Then follows
2 Extended_event_descriptor[i](11+α) to provide a more detailed
3 description of the event (such as in the format of the program
4 content shown in Fig. 10) than the description provided by the
5 Short event descriptor.

6 Thereafter are audio_component_descriptor[i](6),
7 video_component_descriptor[i](3), and
8 subtitle_component_descriptor[i](6). The subsequent CA-
9 identifier_descriptor[i](4) indicates whether the event is
10 scrambled, whether reception is restricted, such as whether a
11 charge is required for reception, and so on. Finally, other
12 descriptors, such as event_still_image_descriptor[i] representing
13 the data of the program window (still-picture data) shown in Fig.
14 6, are provided.

15 Fig. 16 illustrates the structure of the
16 event_still_image_descriptor[i] (still-picture format). As shown
17 in Fig. 16, an 8-bit descriptor-tag is disposed as leading data
18 to represent that the information which follows is still-picture
19 data. Then, 8-bit descriptor-length indicates the overall format
20 length; and 8-bit descriptor-number and 8-bit last-descriptor-
21 number designate the number of the descriptor and the last
22 (maximum) descriptor, respectively. Finally, image_structure
23 representing substantial image data of the still picture is
24 positioned. This image_structure is formed of an 8-bit
25 format_identifier, a 32-bit image_size indicator and the

1 image_data itself. The format_identifier represents the ID of
2 the image_data. When the format_identifier is 0x10, the
3 image_data is identified as black-and-white binary image data.
4 If the format_identifier is 0x11, the image_data is identified as
5 black-and-white 256-step image data. If the format_identifier is
6 0x12, the image_data is identified as RGB image data, with each
7 color being formed of 8 bits. When the format_identifier is
8 0x20, the image_data is identified as having been compressed by
9 the JPEG technique. In the embodiment shown in Fig. 1, the
10 reduced-size still image frame forming the program window is
11 compressed by the JPEG technique, and the format_identifier is
12 0x20. When the image_data is binary black-and-white image data,
13 the number of bits included therein may not be an integral
14 multiple of 8 bits, in which case, "dummy data" is stuffed into
15 the image_data field to "fill in" this field.

16 Fig. 17 illustrates the structure of the Time Data
17 Table (TDT). The TDT is formed of the common structure 1(3) and
18 the UTC_time(5). In addition to the above-described tables, the
19 Service Information (SI) includes the Program Map Table (PMT)
20 shown in Fig. 18 and the Program Association Table (PAT)
21 illustrated in Fig. 19.

22 The PMT includes, as shown in Fig. 18, the common
23 structure 1(3), the transport_stream_id(2), the common structure
24 2(3), and program_map_id_loop[0](4) to program_map_id_loop[N](4).
25 Finally CRC_32(4) is provided. Each program_map_id_loop[i](4) is

1 formed of program_number[i](2) and program_map_PID[i](2) (or
2 network PID) wherein PID represents packet id. The
3 program_number represents the program used to implement the
4 corresponding program_map_PID. For example, when the program
5 number is set to 0x0000, the PID in the next-following
6 program_map_PID acts as network_PID. The values of the
7 program_number other than 0x0000 are defined by the user. In
8 this program_number field, the same value cannot be taken in the
9 Program Association Table (PAT). For example, if the
10 program_number is used for specifying the broadcast channel, the
11 network_PID defines the PID of a transport stream packet
12 including the Network Information Table (NIT). Although the
13 value of the network_PID (as well as the value of the
14 program_map_PID) can be defined by the user, the user cannot
15 assign a value reserved for another use. The presence of the
16 network_PID is optional. The program_map_PID specifies the PID
17 of a transport stream packet containing the effective PMT for the
18 program defined by the program_number. Two or more
19 program_map_PIDs cannot be allocated to the program_number.

20 In the PAT illustrated in Fig. 19, the 10-byte header
21 is formed of the common structure 1(3), a program_number(2), the
22 common structure 2(3), and PCR_PID(1.375). The PCR_PID indicates
23 the PID of the transport stream packet that includes the program
24 clock reference (PCR) field effective for the program defined by
25 the program-number. If there is no PCR related to the defined

1 program with respect to a private stream, this field assumes the
2 value of 0x1FFF. There follows program_info_length(1.5) to
3 specify the byte number of the following descriptor, and then the
4 program info descriptors, including CA_descriptor,
5 Copyright_descriptor, Max_bitrate_descriptor, etc. Thereafter
6 are stream type loop[0](5+ α) to stream type loop[N](5+ α), and
7 CRC_32(4). Each stream type loop includes stream_type(1) and
8 elementary PID(2). The stream_type defines the type of payload
9 or indicates that the elementary stream transmitted in a packet
10 has the PID specified by the elementary_PID. The value of the
11 stream_type is defined by the MPEG2 technique. The
12 elementary_stream_PID specifies the PID of the related elementary
13 stream and the PID of the transport stream packet which transmits
14 this data. Following the elementary_PID are 12-bit
15 ES_info_length (1.5): the first two bits of which are 00, and
16 after these bits the byte number of the descriptor of the
17 following related elementary stream. Then follows ES info
18 descriptors[N] which include CA_descriptors and other
19 descriptors.

20 One representation of receiving apparatus which
21 incorporates the present convention is illustrated in Fig. 20.
22 Here, the receiving apparatus is referred to generically as
23 audio/video equipment 1 which comprises a receiver/decoder 2
24 coupled to a suitable antenna 3 for receiving and decoding the
25 multiplexed program and EPG data transmitted by the apparatus

1 shown in Fig. 1 and for supplying the decoded program and EPG
2 data to a monitor 4 for display. Antenna 3 may comprise a DSS
3 dish receiver, a communications satellite antenna or other
4 suitable antenna equipment adapted to receive the program and EPG
5 data. Receiver/decoder 2 is described in greater detail below
6 and is responsive to infra-red (IR) signals transmitted thereto
7 from a suitable IR module 51 included in a remote control device
8 5. The functions commanded by the remote control device are
9 described in greater detail below; and Fig. 24 is a clear
10 representation of one embodiment of the remote control device.
11 It will be appreciated that remote control device 5 is operable
12 to select broadcast channels, adjust the audio volume and utilize
13 the EPG data, as discussed above.

14 Receiver/decoder 2 is coupled to a monitor 4 by
15 suitable connecting leads 11 and 12. In the preferred
16 embodiment, connecting lead 11 supplies video and audio
17 information to the monitor and connecting lead 12 supplies
18 control signals thereto. For example, connecting lead 11 may
19 include two or three separate lines, one for RF video, one for
20 left-channel audio, and one for right-channel audio signals.
21 Connecting lead 12 may supply suitable commands to the monitor
22 such as audio volume control, picture characteristic control,
23 power on/off control, and the like. It will be understood that
24 monitor 4 may comprise a conventional television receiver
25 connected to the receiver/decoder in much the same way as

1 conventional television receivers are connected to cable set-top
2 boxes. Alternatively, monitor 4 may comprise a multimedia
3 monitor known to those of ordinary skill in the art.

4 Fig. 21 is a schematic representation of the electrical
5 connections between receiver/decoder 2, antenna 3 and monitor 4.
6 For completeness, Fig. 21 also depicts remote control device 5.
7 Antenna 3 is coupled to receiver/decoder 2 by a low noise block
8 (LNB) downconverter 3a which, as is known, converts a satellite-
9 transmitted signal to a signal of suitable frequency compatible
10 with consumer video devices, such as receiver/decoder 2. The
11 receiver/decoder supplies to monitor 4 audio and video signals
12 via connection 11, as mentioned above and as will be described
13 below in conjunction with Fig. 23.

14 Control signals also are transmitted between the
15 receiver/decoder and the monitor, such as between control
16 sections 2A and 4A, provided on these respective devices.

17 Fig. 22 illustrates one embodiment of receiver/decoder
18 2, which includes a power on/off button 111 disposed on a front
19 panel 40 thereof. A suitable power indicator 112, such as an
20 LED, displays whether power is supplied to the receiver/decoder.
21 Additional LEDs 113 and 114 also are provided, to indicate
22 whether the receiver/decoder is operable to receive broadcast
23 channels transmitted via satellite, such as by DSS transmission,
24 or via conventional over-the-air (or cable) transmission. A

1 TV/DSS changeover button 123 selects the TV or DSS mode of
2 operation.

3 Satellite communication provides substantial
4 flexibility and the ability for a service provider to transmit
5 individual messages to the consumer. For example, a message
6 relating to subscription charges, bill payment, and the like, may
7 be transmitted, and an indication of receipt of such a message is
8 provided by a message LED 114. This LED is reset when the
9 consumer retrieves and displays the message on, for example,
10 monitor 4.

11 Receiver/decoder 2 is provided with a menu switch 121
12 which, when operated, displays a menu on the display screen of
13 monitor 4. This display is cleared in response to the operation
14 by the user of an exit button 122.

15 Cursor positioning buttons 117-120 are user-operated to
16 move a cursor display, such as shown in Fig. 4, on the display
17 screen. The cursor thus may be moved to a desired EPG still
18 image or to a particular location on the displayed program table
19 (Fig. 8). A select button 116 may be operated by the user to
20 select a particular program identified by the position of the
21 cursor. In a preferred application of this invention, the
22 operation of select button 116 sets the receiver/decoder to the
23 particular broadcast channel at the particular time identified by
24 the EPG data that has been selected by the cursor. For example,
25 and as described above, receiver/decoder 2 is tuned to the

1 broadcast channel which carries the program identified by the EPG
2 still image at which the cursor is positioned.

3 A block diagram of one embodiment of receiver/decoder 2
4 which incorporates the present invention is illustrated in Fig.
5 23. The receiver/decoder is provided with a front end 20, a CPU
6 29, a demultiplexer 24, a data buffer memory 35 and MPEG decoders
7 25 and 26. Front end 20 is coupled to antenna 3 by way of LNB
8 downconverter 3a to receive the several broadcast and promotion
9 channels that are received by the antenna. The front end
10 includes a tuner 21 operable to be tuned to a particular
11 broadcast or promotion channel in order to receive the data
12 transmitted over that channel. The output of tuner 21 is coupled
13 to a quadrature phase shift key (QPSK) demodulator 22 which recovers
14 the program and EPG data transmitted over the broadcast channel
15 to which tuner 21 is tuned. The demodulated digital data then is
16 subjected to error correction by error correcting circuit 23,
17 whereupon the recovered program and EPG data are supplied to
18 demultiplexer 24.

19 CPU 29 is coupled to tuner 21, QPSK demodulator 22,
20 error correcting circuit 23 and demultiplexer 24 to control the
21 individual operations of such circuits. For example, the CPU
22 controls the tuning operation of tuner 21 in a manner
23 conventionally used to control video and audio tuners. The CPU
24 also is coupled to control section 2A to control the various
25 control signals transmitted from receiver/decoder 2 to monitor 4

1 and, likewise, to detect, decode and interpret control signals
2 that are returned to the receiver/decoder from the monitor.
3 Front panel 40 is coupled to the CPU, whereby the CPU detects
4 when power on/off button 111 is operated. Also, an IR receiving
5 section 39 is coupled to CPU 29 to supply to the CPU various
6 commands that are generated by remote control device 5 and
7 supplied as IR signals to the receiver/decoder.

8 As mentioned above, one or more of the broadcast
9 channels may carry pay-per-view programs, special programs
10 referred to as "premium" programs and other programs requiring
11 preestablished subscription, clearance or acceptance. The
12 program data transmitted over such broadcast channels is
13 scrambled and encrypted, thereby providing security against the
14 unauthorized decoding and display of such programs.

15 Demultiplexer 24 preferably includes decrypting circuitry
16 requiring the presence of a decrypting key and decrypting
17 software in order to decode such encrypted programs. An
18 interface 32 is coupled to demultiplexer 24 and includes suitable
19 circuitry which, for example, may be mounted on an IC card having
20 a CPU, ROM, RAM and other conventional digital circuits typically
21 used to decipher encrypted digital data. A conditional access
22 module (CAM) 33 may include some or all of the aforementioned
23 digital circuits, thereby providing the demultiplexer with the
24 deciphering key needed to decrypt the received programs. CAM 33
25 also stores payment information and other data relevant to the

1 user's account with the service provider to prevent unauthorized
2 access to and use of the decrypting software and deciphering key.

3 Demultiplexer 24 supplies to data buffer memory 35 the
4 decrypted program and EPG data received from front end 20. The
5 buffer memory may be comprised of a DRAM and may include an EPG
6 area 35A in which the EPG data is especially stored. As will be
7 described below, the EPG area stores EPG image and text data
8 which are selectively retrieved and displayed as, for example,
9 the still image data shown in Fig. 4, the still image and text
10 data shown in Fig. 7, the program tables shown in Figs. 8 and 9
11 or the detailed program information shown in Fig. 10.

12 Although buffer memory 35 is shown as a DRAM, it will
13 be appreciated that the program and EPG data may be stored in a
14 static random access memory (SRAM), if desired. The buffer
15 memory also stores the audio data that is recovered from the
16 broadcast channel by front end 20.

17 Demultiplexer 24 is controlled by CPU 29 to read from
18 buffer memory 35 the video and audio program data that had been
19 received by front end 20 and separated by the demultiplexer. It
20 is recalled that the video and audio data which are received by
21 receiver/decoder 2 are in compressed form; and demultiplexer 24
22 reads the compressed video data from the buffer memory and
23 supplies same to MPEG video decoder 25. Similarly, the
24 demultiplexer reads the stored compressed audio data from buffer
25 memory 35 and supplies same to MPEG audio decoder 26. The MPEG

1 video decoder cooperates with a memory DRAM 25a and the MPEG
2 audio decoder cooperates with a memory DRAM 26a to store the
3 compressed video and audio data, respectively, and to perform a
4 decoding/decompression operation thereon. MPEG decoding
5 techniques are known to those of ordinary skill in the art and
6 form no part of the present invention per se. Hence, further
7 description of such MPEG decoding of the video and audio data is
8 not provided herein.

9 MPEG decoder 25 supplies the decoded video signals to,
10 for example, an NTSC encoder 27 whereat the video information is
11 encoded into luminance and chroma signals Y and C and into a
12 composite video signal. The luminance and chroma signal Y and C
13 are supplied to respective outputs by buffer amplifiers 28Y and
14 28C, respectively, these outputs constituting what is known
15 conventionally as the so-called S video output. The composite
16 video signals are supplied to a composite video output by a
17 buffer 28V. In addition, the composite video signal is coupled
18 to an RF modulator 41 which supplies an RF video output that is
19 compatible with conventional receivers.

20 Similarly, MPEG audio decoder 26 recovers digital audio
21 data from the audio program data supplied thereto; and this audio
22 data is converted to analog form by a D/A converter 30. The D/A
23 converter produces left-channel and right-channel stereophonic
24 audio signals which are coupled to left and right outputs by way
25 of buffer amplifiers 31L and 31R, respectively. A monaural audio

1 signal also is supplied from D/A converter 30 to RF modulator 41,
2 whereat the audio signal is combined with the composite video
3 signal supplied from NTSC encoder 27, thereby forming a composite
4 television signal at the RF output of the RF modulator. This
5 composite television signal output is produced by the RF
6 modulator when TV/DSS selector button 123 is operated to select
7 the DSS mode. When, however, the TV mode is selected, RF
8 modulator 41 essentially bypasses whatever outputs may be
9 supplied thereto by the NTSC encoder and the D/A converter 30 so
10 as to shunt to the RF output whatever signals may be supplied to
11 the RF input thereof. Thus, receiver/decoder 2 may be used to
12 couple to monitor 4 signals that may be coupled to the
13 receiver/decoder from a VCR, a personal computer or other
14 audio/video device. Hence, the receiver/decoder may be used to
15 receive several different types of signals connected thereto via
16 separate input ports and to select one of those signals to be
17 supplied to monitor 4 via the RF output.

18 Fig. 23 illustrates various memory devices 36, 37 and
19 38 which, typically, are used with CPU 29 to control the
20 operations of the CPU and to permit the CPU to carry out various
21 processing functions. For example, ROM 37 stores the operating
22 program for the CPU which permits the processor to execute the
23 tuning control function, QPSK demodulation function, error
24 correction function and data detection, separation and decoding
25 functions. EEPROM 38 stores data relating to the operation of

1 the receiver/decoder that otherwise would be erased when the
2 power is turned off. For example, the EEPROM stores the identity
3 of the last broadcast channel to which tuner 21 had been tuned
4 prior to power turn-off, the identities of those broadcast
5 channels to which the tuner had been tuned the most during, for
6 example, the last four weeks (e.g. an indication of the user's
7 "favorite" channels), the tuning history of tuner 21, and the
8 like. As a result of this stored data, when power is turned on,
9 CPU 29 controls tuner 21 to tune either to the last broadcast
10 channel that had been received prior to power turn-off or to the
11 broadcast channel which is determined to be the user's favorite
12 channel. The program stored in ROM 37 preferably determines
13 which of these alternatives is selected. The EEPROM and the ROM
14 also are used to control CPU 29 to maintain an appropriate timing
15 function, even when power is turned off. For example, this
16 enables the CPU to maintain the current time in hours, minutes,
17 seconds and also to control timed functions, such as to supply to
18 a VCR connected thereto via control line 12 a Start Signal when a
19 particular time is reached, thereby initiating a timed (or
20 programmed) recording operation. SRAM 36 is used as a working
21 memory for CPU 29 to assist in the aforementioned and other
22 processing operations.

23 It is recalled that, to reduce the amount of EPG data
24 that must be transmitted in order to effect the displays shown
25 in, for example, Figs. 4-10, the total amount of data needed to

1 display the various icons and logos preferably are not,
2 transmitted as part of the EPG data. Rather, such graphic
3 display data is pre-stored in a suitable area of DRAM 25a and
4 access data, such as bit-map data, is transmitted as part of the
5 EPG data and used to access such pre-stored display data. CPU 29
6 is coupled to MPEG video decoder 25 to control the MPEG video
7 decoder to retrieve such display data from DRAM 25a when the CPU
8 senses the receipt by the multiplexer 24 of such access data.
9 The stored display data then is read from the DRAM, decoded (i.e.
10 MPEG-expanded) by decoder 25 and supplied to NTSC encoder 27 for
11 superposition on the video display, thereby resulting in the
12 display of such icons and logos in the manner depicted in Figs.
13 4-10. As will be described below in conjunction with Fig. 28,
14 the EPG data stored in, for example, EPG area 35A of buffer 35 is
15 read from the EPG area, temporarily stored in a dedicated area of
16 DRAM 25a, referred to as an On Screen Display (OSD) area and
17 retrieved from the OSD area by MPEG decoder 25 to form the EPG
18 display shown in Figs. 4-10.

19 Fig. 23 also illustrates a modem 34 for interconnecting
20 CPU 29 to, for example, a telephone line. The modem is used to
21 exchange billing information, deciphering keys, decrypting
22 software, and the like between receiver/decoder 2 and the service
23 provider.

24 Referring to Fig. 24, there is illustrated one
25 embodiment of remote control unit 5 that advantageously is used

1 with the present invention. As shown, the remote control unit is
2 provided with various operator-actuated selector switches which,
3 preferably, are configured as pushbuttons and are referred to
4 herein simply as "buttons". Fig. 24 also illustrates the IR
5 transmitter 51 which transmits to receiver/decoder 2 various
6 commands generated by the operation of one or more of the
7 illustrated buttons via infra-red transmission.

8 The buttons which are used primarily in conjunction
9 with displaying the EPG data that is transmitted to and stored in
10 receiver/decoder 2 are provided in the generally central portion
11 of the remote control unit. Cursor control buttons 135, 136, 137
12 and 138 are operated to move the cursor across the display screen
13 in the directions represented by the arrows shown on these
14 buttons. For example, the cursor may be positioned at or
15 adjacent a desired still picture shown in Fig. 4 or at a desired
16 program table entry shown in Figs. 8 or 9, whereupon the
17 operation of button 131 selects the program identified by that
18 still picture. The operation of button 145 retrieves from buffer
19 memory 35 the EPG data illustrated in Fig. 7, which then is
20 displayed. Alternatively, the operation of button 158 causes CPU
21 29 to control tuner 21 to tune to the broadcast channel on which
22 the program identified by the selected still picture is
23 transmitted.

24 The operation of button 134 causes CPU 29 to control
25 MPEG decoder 25 to read from DRAM 25a menu display information

1 that is stored in the OSD area of the DRAM. This menu
2 information may be of the conventional type normally used with
3 television receivers, VCR's and the like, and also may permit the
4 user to select different types of EPG displays, such as the still
5 picture display shown in Fig. 4, the program table display shown
6 in Fig. 8 or Fig. 9 or the program content display shown in Fig.
7 10. Button 134 may be used in conjunction with button 144 to
8 enable a particular type of EPG display to be selected.

9 A numerical keypad 138 is operated to select a
10 broadcast channel in the usual manner. A promotion channel may
11 be selected for display simply by operating button 157. It is
12 appreciated that when button 157 is operated, tuner 21 is tuned
13 to the broadcast frequency of the promotion channel. Preferably,
14 if plural promotion channels can be received, successive
15 actuations of button 157 advance the tuner from one promotion
16 channel to the next.

17 Channel up/down buttons 133 and volume up/down buttons
18 132 permit the user to scroll through successive broadcast
19 channels and to increase and decrease the audio volume, as
20 desired.

21 A power on/off button 153 controls power to the
22 receiver/decoder. Similarly, a television power on/off switch
23 152 is used to control power supplied to monitor 4. The
24 actuation of a mute switch 151 mutes the audio output of the
25 monitor; and the actuation of switch 154 toggles the

1 receiver/decoder between its satellite antenna input and
2 conventional television input. It will be appreciated that
3 switch 154 serves substantially the same function as switch 123
4 shown in Fig. 22.

5 An alternative arrangement to the cursor control and
6 EPG selection buttons is shown in Fig. 25. Here, button 131
7 simply is positioned adjacent the cursor-control buttons, rather
8 than being surrounded by those buttons as shown in Fig. 24.

9 Fig. 26 schematically illustrates the internal
10 electrical connections between microcomputer 71 contained within
11 the remote control device, button matrix 82 and IR transmitter
12 51. The microcomputer includes a CPU 72, a ROM 73 and a RAM 74,
13 as is conventional. Button matrix 82 represents all of the
14 pushbuttons shown in Fig. 24, and this button matrix is polled by
15 the microcomputer to detect and determine which button is
16 actuated. The command selected via that button is generated by
17 the microcomputer and supplied to an LED driver 75 which drives
18 an LED 76 included in IR transmitter 51. Thus, LED 76 transmits
19 IR signals representing the command generated by microcomputer 71
20 in response to the actuation of a particular button included in
21 button matrix 82.

22 Fig. 27 schematically illustrates the manner in which
23 EPG data is combined with program data, transmitted by the guide
24 and the normal transponders, and received by receiver/decoder 2.
25 Program data is comprised of video data and audio data; and EPG

1 data is included in service information (SI) data, the latter
2 containing the EPG data as well as other data typically
3 transmitted by the service provider. A packet is formed of the
4 program and SI data; and successive packets are transmitted to a
5 respective transponder (four transponders are illustrated in Fig.
6 27) at suitable frequencies, such as in the frequency range 12.25
7 GHz to 12.75 GHz. As an example, if the program data of one
8 broadcast channel is structured as a packet, a normal transponder
9 may be supplied with ten packets of program data representing the
10 program information transmitted over 10 respective broadcast
11 channels. The SI data is multiplexed with these packets, such as
12 described above in conjunction with Fig. 1. Depending upon the
13 number of transponders that are provided in a satellite, 10 times
14 that number of broadcast channels are, of course, transmitted.

15 The packets of program and SI data transmitted by the
16 various transponders are received by receiver/decoder 2; and as
17 shown in Fig. 27, the program and SI information are separated
18 from the respective packets. Front end 20 (discussed in
19 conjunction with Fig. 23) may be tuned to the transmission
20 frequency of a particular transponder, whereupon the packets of
21 program and SI data received from that transponder are
22 demodulated. The multiplexer 24 separates the program and SI
23 data from the received packets and temporarily stores the
24 separated data in data buffer 35. As is typical, each SI packet
25 includes a header; and although this header is used for various

1 detection and synchronizing purposes, it is not needed for the
2 actual display of the EPG data. Hence, the EPG data included in
3 the separated SI packet is stored in EPG area 35A of data buffer
4 35, as depicted in Fig. 27. The video packet, after being
5 separated, is stored in DRAM 25a and the audio packet, after
6 separation, is stored in DRAM 26a. MPEG decoder 25 thus decodes
7 the video data stored in DRAM 25a and, similarly, MPEG decoder 26
8 then decodes the audio data stored in DRAM 26a.

9 As a numerical example, the transmission rate of each
10 transponder channel is on the order of 30 Mbits/second.
11 Consistent with MPEG encoding, video images exhibiting rapid
12 motion are represented by MPEG data having a large number of
13 packets. On the other hand, video images having relatively
14 little motion, such as a news program, a talk show, or the like,
15 may be represented by MPEG data having a smaller number of
16 packets. A transponder thus transmits a smaller number of
17 programs exhibiting rapid motion and a larger number of programs
18 exhibiting relatively little motion. In this manner, the average
19 number of packets transmitted by each transponder is about the
20 same.

21 The manner in which EPG data is stored and retrieved at
22 receiver/decoder 2 now will be explained in conjunction with Fig.
23 28. Depending upon the packet header data, CPU 29 controls
24 demultiplexer 24 to direct the incoming data to the appropriate
25 memory destination. For example, EPG data is directed to buffer

1 memory 35, MPEG video data is directed to DRAM 25a and MPEG audio
2 data is directed to DRAM 26a. The demultiplexer includes
3 registers 24a which store the appropriate memory addresses into
4 which the received EPG, video and audio data are directed. Of
5 course, as mentioned above, all of the received data initially is
6 stored temporarily in buffer memory 35, whereafter the data is
7 distributed to the appropriate memory and to the proper addresses
8 in that memory, namely to the EPG area 35a, to DRAM 25a and to
9 DRAM 26a.

10 Fig. 28 illustrates an enlarged version of EPG area
11 35a. It is seen that the EPG data received from a normal
12 transponder contains, for each of, for example, 80 broadcast
13 channels, still image data (EPG 1), and text data (EPG 2). As
14 mentioned above, the text data contains program table data
15 associated with 24 hours of programs transmitted over those 80
16 channels. The EPG text data also contains program content data
17 associated with, for example, four hours of programs transmitted
18 over those 80 channels. The EPG image data (EPG 1) and the EPG
19 text data (EPG 2) are stored in the EPG area.

20 When EPG data is received from the guide transponder it
21 is recalled that a larger amount of EPG data is present. In
22 particular, the guide transponder transmits EPG text data (EPG 2
23 + EPG 3) representing program table information associated with
24 150 hours of programs transmitted over 80 channels. The text
25 data (EPG 2 + EPG 3) also contains program content information

1 associated with 70 hours of programs transmitted over those 80
2 channels. Fig. 28 schematically illustrates the storage in EPG
3 area 35a of the EPG text data (EPG2 + EPG 3) transmitted by the
4 guide transponder.

5 When the remote control device is operated to display
6 the EPG data stored in EPG area 35a, the data stored in a
7 discrete portion thereof, such as in a display area 250, is
8 retrieved and written into OSD area 25aA of DRAM 25a. For
9 example, when the user actuates button 144 of remote control
10 device 5, the EPG image data identifying those programs which are
11 currently being transmitted by, for example, all 80 of the
12 broadcast channels are stored in the display area 250 and are
13 read therefrom and written into the OSD area. Alternatively, if
14 the user operates the remote control device for the purpose of
15 displaying a table of EPG information, such as the table shown in
16 Fig. 8, the EPG text data containing program table information
17 for those programs transmitted over, for example, a four hour
18 period are read from display area 250 and written into OSD area
19 25aA. MPEG video decoder 25 reads and decodes the data stored in
20 OSD area 25aA and, as shown in Fig. 23, supplies the decoded EPG
21 data to NTSC encoder 27 whereat the EPG data is superimposed on
22 program video data and displayed on monitor 4, such as shown in
23 Fig. 4 (if EPG image data had been written into the OSD area) or
24 as shown in Fig. 8 (if EPG program table data had been written
25 into the OSD area).

1 As depicted in Fig. 28, ROM 37, which contains the
2 operating programs for CPU 29, includes a compressed code
3 conversion dictionary which is used to expand compressed
4 character data (i.e. the text data received by receiver/decoder
5 2) to a form suitable for display. The ROM also includes an
6 address conversion table which is used by the CPU to read the
7 appropriate character font in response to font bit map data that
8 is included in the EPG data. ROM 37 also includes a logo data
9 address conversion table which uses the aforementioned access
10 data transmitted with the EPG data to read out the pre-stored
11 logos and icons for display.

12 Therefore, it is seen that, by transmitting EPG image
13 and text data, still image displays of the type shown in Fig. 4
14 may be presented to the user, thereby identifying those programs
15 which currently are being transmitted as well as those programs
16 which will be transmitted over respective broadcast channels.
17 The user may display more detailed information relating to those
18 programs, such as the display in Fig. 7, by operating the
19 appropriate buttons of remote control device 5. Indeed, the
20 present invention provides the capability of displaying table
21 information, such as shown in Figs. 8 and 9, or more detailed
22 information relating to a particular program, such as shown in
23 Fig. 10. These displays are superimposed on the video program
24 then being received by the user's receiver/decoder, such video
25 program being either a "normal" program or a "promotion" program,

1 as has been described. Still further, the user may position a
2 cursor at or adjacent a particular EPG still image and then, by
3 operating the remote control device in the manner discussed
4 above, the tuner included in the user's receiver/decoder is tuned
5 to the broadcast channel identified by the EPG still image at
6 which the cursor is positioned.

7 While the present invention has been particularly shown
8 and described with reference to preferred embodiments as well as
9 alternatives thereto, it will be readily appreciated by those of
10 ordinary skill in the art that various changes may be made to the
11 invention disclosed herein without departing from the spirit and
12 scope of this invention. It is intended that the appended claims
13 be interpreted as including the embodiments which have been
14 discussed above, the various alternatives which have been
15 described as well as all equivalents thereto.
16